
Hydrocharitaceae from Central Brazil: A New Species of *Egeria* and a Note on *Apalanthe granatensis*

Samantha Koehler

Departamento de Botânica, I.B., UNICAMP, Caixa Postal 6109, 13083-970 Campinas, SP, Brazil. skoehler@unicamp.br

Claudia Petean Bove

Departamento de Ciências Naturais, E.C.B., UNI-RIO, Frei Caneca 94 5° andar, 20221-040, Rio de Janeiro, RJ, Brazil. cpbove@ibpinet.com.br

ABSTRACT. *Egeria heterostemon* (Hydrocharitaceae), a new species from central Brazil, is described and illustrated. It is distinguished from congeneric species by its flowers having heteromorphic whorls of stamens, and by its long-stalked clavate staminodes, which are strongly papillose distally. Further, taxonomic notes on *Apalanthe granatensis* (Humboldt & Bonpland) Planchon are presented, and a key to species of both genera is provided.

Key words: *Apalanthe*, Brazil, *Egeria*, Hydrocharitaceae.

The family Hydrocharitaceae consists of 17 genera, 9 of which are found in South America (Cook, 1996). Of these, *Apalanthe* Planchon and *Egeria* Planchon are considered here. Molecular phylogenetic analysis of the Hydrocharitaceae strongly supports the genera *Apalanthe*, *Egeria*, and *Elodea* Michaux as a monophyletic group, with *Egeria* + *Elodea* as the sister group of *Apalanthe* (Les et al., 1997). As a result of fieldwork for the *Aquatic Flora of the Araguaia River Region Project*, a third species of *Egeria* from the states of Mato Grosso and Goiás, in central Brazil, is described below. New taxonomic data for *Apalanthe granatensis* (Humboldt & Bonpland) Planchon are also presented.

EGERIA PLANCHON

The genus *Egeria* consists of two partly sympatric species, both described by Planchon in 1849. St. John (1961) published a monograph of the genus as well as additional taxonomic studies (St. John, 1962, 1967). A more recent and complete taxonomic revision was published by Cook and Urmi-König (1984), who considered two species, *E. densa* Planchon and *E. najas* Planchon. *Egeria* is morphologically distinguished from other Hydrocharitaceae mainly by its paired scale leaves at the base of

lateral shoots; intravaginal squamules with entire margins; unisexual flowers; petals much exceeding the sepals; nectaries on male flowers and staminodia on female flowers that are yellow to orange. According to Cook and Urmi-König (1984) the genus occurs from southeastern Brazil (Minas Gerais and Espírito Santo) to Uruguay, Paraguay, and Argentina. Both *Egeria* species are separated principally by the shape of the filaments and nectaries of the male flowers and by the shape of the staminodia of the female flowers. Recently, two new occurrences of *E. najas* were recorded for the Brazilian states of Mato Grosso do Sul (Pott & Pott, 1997) and São Paulo (Lidyane Aona, pers. comm.).

Egeria heterostemon S. Koehler & C. P. Bove, sp. nov. TYPE: Brazil. Goiás: Estrada Aruanã-Goiânia, 19 km from Aruanã, 29 May 1997 (fl), C. P. Bove, S. Koehler & J. Morrey-Jones 225 (holotype, RB; isotypes, CPAP, HUEFS, HUNI, MBM, MO). Figure 1A–G.

Herba dioica aquam dulcem habitans, caule irregulariter ramoso. Folia opposita vel verticillata interdum prope basin alterna, saepe curva, sessilia, linearia, 6–8 mm longa, ca. 1 mm lata. Flores emersi; sepalis 3, liberis, viridibus; petalis 3, liberis, albis. Flores masculi gemini; androecio ex staminibus dimorphis 9 in verticillos alternos 3 dispositis constante, filamentis verticillorum externi et medii glabris, erectis, a basi ad apicem gradatim angustatis eis verticilli interni claviformibus recurvatis supra pilosis; pollinis granis sphaericis, inaperturatis, spinosis; nectario solitario centrali. Flores feminei solitarii; staminodiis claviformibus, 1–1.5 mm longis, stipitem ca. 0.7 mm longum includentibus, stylis 3, 2 vel 3 fassis, nectarium ad basim gerentibus.

Dioecious, submerged or partially emerged, freshwater herbs. Stems monomorphic, elongate, irregularly branched, 0.5–1.3 mm diam. with internodes 1–5 mm long. Prophylls paired, deltate, 1.5–2 × 1–1.5 mm. Leaves opposite or whorled, sometimes alternate near the base, frequently recurved,

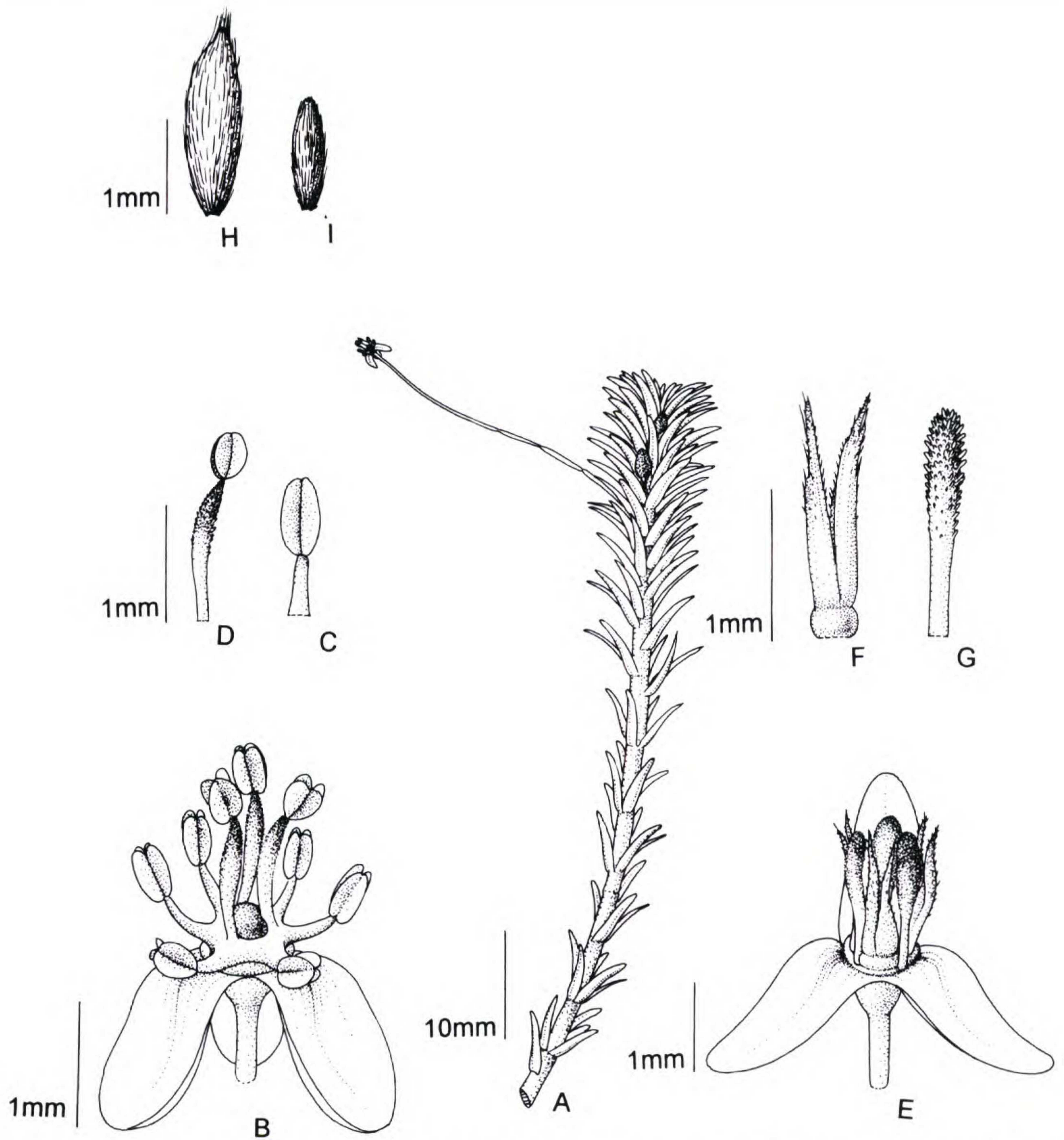


Figure 1. A–G. *Egeria heterostemon* S. Koehler & C. P. Bove. —A. Habit. —B. Male flower. —C. Stamen of outer whorl. —D. Stamen of inner whorl. —E. Female flower. —F. Style. —G. Staminode. (Drawn from the holotype, Bove, Koehler & Morrey-Jones 225.) H, I. *Apalanthe granatensis* (Humboldt & Bonpland) Planchon. —H. Seed (Costa, Pupo & Araújo s.n.). —I. Seed (Bove, Costa & Muratori 114). Drawn by Eduardo H. P. Kickhöfel.

sessile, linear, gradually attenuate to an acute apex, 6–8 × 0.5–1.0 mm, in whorls of 4 to 10 on sterile nodes; margins and apex bearing unicellular, thick-walled prickle-hairs, 0.7–1 mm long. Intravaginal squamules usually 2 in each leaf axil, ovoid to orbicular, 0.1–0.2 × 0.05–0.1 mm. Spathes axillary, sessile, ovoid, 5–10 mm long, with 2 apical teeth. Male flowers: 2 in each spathe, rarely more, pedicels up to 40 mm long, borne above the water surface; sepals 3, free, green, ovate and boat-shaped, 2 × 1 mm; petals: 3, free, white, delicate, subor-

bicular, 2.5–4 × 2–3 mm; stamens 9, in alternate whorls of 3, free; outer and median whorls: filaments glabrous, erect, broad at the base, attenuate to the apex, 0.3–0.5 mm long, anthers basifixed, 0.4–0.6 mm long, opening by longitudinal slits; stamens in outer whorl usually smaller than those of median whorl, although similar in form. Inner whorl: filaments clavate, erect, strongly pilose distally, apically constricted below the anther, 0.8–1 mm long; anthers basifixed, 0.3–0.5 mm long, opening by longitudinal slits. Pollen grains large,

shed as monads, (58–)70(–80) μm diam., spherical, inaperturate, echinate, surface granulate between spines, spines 3.5 μm long, exine ca. 1 μm thick. Nectary 1, central, 3-lobed, 0.2 mm diam., with lateral lobes shorter than the central lobe. Female flowers: 1 in each spathe, borne above the water surface, sessile; sepals 3, free, green, ovate and boat-shaped, 2 \times 1 mm wide; petals 3, free, white, delicate, suborbicular, 3 \times 2 mm; staminodes clavate, strongly papillose distally, 1–1.5 mm long, including a stalk up to 0.7 mm long; ovary inferior, ovoid, up to 3 mm long, attenuate above in an elongated free hypanthium, 10–35 mm long, 3-carpellate, 1-locular, with ca. 30–40 ovules with parietal placentation; styles 3, two-thirds divided along length, 1–2 mm long. Fruit unknown.

Distribution and habitat. Median Araguaia River region in the states of Mato Grosso and Goiás, in central Brazil, along stream margins and in swampy environments.

Phenology. Flowering was recorded for the months of May and October. As previously recorded for this genus (St. John, 1961; Cook & Urmi-König, 1984), male individuals were strongly predominant in the two populations investigated by us in Goiás.

Egeria heterostemon is distinguished from other *Egeria* species by its flowers having two different forms of stamens: the outer and median whorls of stamens have clavate and strongly papillose filaments, while the inner whorl stamens have attenuate and glabrous filaments. The other *Egeria* species have stamens with filaments either clavate and strongly papillose (*E. densa*) or elongated and glabrous (*E. najas*). Staminodes are clavate, rounded toward the apex, strongly papillose distally, and bearing a long stalk (ca. 0.7 mm). Staminodes of *E. densa* are also clavate and strongly papillose distally, but somewhat more attenuate to the apex and bearing a shorter stalk (only to 0.2 mm), while *E. najas* presents staminodes of cylindrical form, which are weakly papillose, with a truncate apex, and no stalk.

Paratypes. BRAZIL. **Mato Grosso:** Estrada Água Boa–Cocalinho a 148 km de Água Boa, 12 Oct. 1997, C. P. Bove 273a, S. Koehler & J. Morrey-Jones (HUNI, RB).

APALANTHE PLANCHON

The genus *Apalanthe* was described by Planchon in 1848 considering the species known as *Elodea guyannensis* L. C. M. Richard. Earlier, Humboldt and Bonpland (1813) had described the same species as *Elodea granatensis*. *Elodea guyannensis* was effectively published only in 1814, although the publication was dated 1812 (see Cook, 1985). Lat-

er, the genus was reduced to a subgenus of *Elodea* by St. John (1963), based on the presence of bisexual flowers. A taxonomic revision published by Cook (1985) reinstated the genus *Apalanthe*, considering vegetative, reproductive, and anatomical characters. It is distinguished morphologically from *Egeria* principally by its bisexual flowers, three stamens in one whorl, prophylls free and lateral or oblique, leaves without idioblasts, and leaf margins with fiber cells. The distribution of *Apalanthe* extends from northern South America (Ecuador to French Guyana), Bolivia, and Brazil, with a southernmost limit of distribution in the states of Rio de Janeiro and São Paulo (Cook, 1985).

Plants collected on field expeditions in the central regions of Brazil showed that fruits and seeds of *A. granatensis* present greater morphological variation than previously described by Cook (1985). According to his work, its fruits are about 5 mm long and contain ca. 6 to 7 seeds that are 2.8–4.5 mm long (including the micropylar beak), with the micropylar beak 0.8–1.5 mm long. These are covered with unicellular hairs ca. 0.8 mm long (Fig. 1H). The specimens collected in two different locations at the Araguaia River region possess larger fruits, 7–13 mm long, with seeds both smaller (1–1.3 mm) and more numerous (25 to 30). Further, these seeds present a reduced micropylar beak (only ca. 0.1 mm long) and shorter unicellular hairs (0.2–0.3 mm long) (Fig. 1I). All other vegetative and reproductive characters correspond to previous descriptions of *A. granatensis*, and, therefore, the new taxonomic data obtained do not justify the description of a new species of *Apalanthe*. The description of an infraspecific category is also not justifiable, since morphological variation, as well as ecological aspects of this species, is still very poorly known. The specimens were found only in swampy environments. Flowering was recorded for the months of February, May, and October. Plants of *Egeria heterostemon* and *A. granatensis* occur sympatrically in the states of Mato Grosso and Goiás (Brazil). In the Estrada Água Boa–Cocalinho (Mato Grosso) both species were collected in the same locality, growing together in intermingled populations. Vegetative distinction can be made by the prophylls as well as by anatomical features cited above.

Specimens of Apalanthe granatensis examined. BRAZIL. **Bahia:** Paratinga, 14 Feb. 1999 (fl, fr), Costa, Pupo & Araújo s.n. (CPAP, HUEFS, HUNI, MBM, MO, RB). **Mato Grosso:** C. do Rosário, Forquilha do Rio, Mar. 1918 (fr), Kuhlmann 1620 (R); Estrada Água Boa–Cocalinho, 148 km from Água Boa, 12 Oct. 1997 (fl), Bove, Lisbôa & Koehler 273b (HUNI, RB); Estrada Água

Boa-Rio das Mortes, 20 Feb. 1993 (fl), *Bove, Costa & Muratori 114* (CPAP, HUNI). **Minas Gerais:** Lagoa Santa, 1954 (fl, fr), *Smith 6707* (R); Lagoa Santa, 1954 (fl, fr), *Smith 6707* (R). **Goiás:** Tupiratins, Brasilândia, R. Feio, 20 Mar. 1976 (fl), *Hatschbach & Kummrov 38497* (MBM); Estrada Aruanã-Goiás, 8.8 km from Aruanã, 29 May 1997, *Bove, Koehler & Morrey-Jones 224* (RB). **Rio de Janeiro:** Estrada Rio-Teresópolis, Baixada Fluminense, 1 Oct. 1964 (fl, fr), *Hatschbach & Pereira 11473* (MBM).

The results presented here indicate that there are insufficient collections of *Apalanthe granatensis* in the central region of Brazil (as suggested by Cook, 1985), as well as for the genus *Egeria*. Considering that the aquatic flora of this region is poorly known, the distribution of the species considered in this study may be a much larger than currently known; more work is needed.

KEY TO APALANTHE AND EGERIA

- 1a. Flowers bisexual; stamens 3; prophylls free, lateral or oblique; leaves without idioblasts, leaf margins with fiber cells *Apalanthe granatensis*
- 1b. Flowers unisexual; stamens 9 (male flowers); prophylls united at base, median; leaves with transparent idioblasts, leaf margins without fiber cells.
 - 2a. Stamens heterogeneous in form; staminodes clavate, ca. 1–1.5 mm long, with rounded apex and bearing a stalk (ca. 0.7 mm long) *Egeria heterostemon*
 - 2b. Stamens homogeneous in form, staminodes elongate, 0.4–2.4 mm long, without a stalk or clavate with an attenuated apex bearing a stalk up to 0.2 mm long.
 - 3a. Leaves mostly in whorls of 4 at sterile nodes, usually spreading, somewhat longer and wider; filaments clavate, constricted below the anther, strongly papillose above; nectaries of male flowers with lateral lobes as long as or longer than central lobe; staminodia of female flowers clavate, with an attenuate apex and bearing a short stalk (ca. 0.2 mm long) *Egeria densa*
 - 3b. Leaves mostly in whorls of 5 at sterile nodes, usually recurved, shorter and thinner; filaments elongate, not constricted below the anther, weakly papillose above; nectaries of male flowers with lateral lobes shorter than central

lobe; staminodia of female flowers elongate and truncate at the apex, without stalk *Egeria najas*

Acknowledgments. We sincerely thank W. Costa for suggesting the exploration of the interesting and still undiscovered aquatic flora of the Araguaia basin as well as for collecting specimens for our study; the curators of the herbaria BHCB, CPAP, HUEFS, MBM, and R for sending material for our study; J. Zanol and P. Paiva for providing the equipment to prepare the illustrations; Eduardo H. P. Kickhöfel for the illustrations; and C. D. K. Cook, D. H. Les, and V. Bittrich for comments on the manuscript.

Literature Cited

- Cook, C. D. K. 1985. A revision of the genus *Apalanthe* (Hydrocharitaceae). *Aquatic Bot.* 21: 157–164.
- . 1996. *Aquatic Plant Book*, 2nd ed. SPB Academic Publishing, The Hague, The Netherlands.
- & K. Urmi-König. 1984. A revision of the genus *Egeria* (Hydrocharitaceae). *Aquatic Bot.* 19: 73–96.
- Humboldt, A. & A. Bonpland. 1813. *Plantae Aequinoctiales*. . . . In ordinem digessit Amatus Bonpland, 2(16): 150, pl. 128.
- Les, D. H., M. A. Cleland & M. Waycott. 1997. Phylogenetic studies in Alismatidae, II: Evolution of marine angiosperms (seagrasses) and hydrophily. *Syst. Bot.* 22: 443–463.
- Planchon, J. E. 1848. Synopsis specierum *Anachardis* et *Apalantes*. *Ann. Mag. Nat. Hist.*, Ser. 2, 1: 85–88, pl. 8.
- . 1849. Sur *L'Anacharis alsinastrum*, plante anglaise supposée nouvelle avec un synopsis des espèces d'*Anacharis* et d'*Apalanthe* et des descriptions de quelques hydrocharidées nouvelles. *Ann. Sci. Nat. (Paris)*, Sér. 3, 11: 79–80.
- Pott, V. & A. Pott. 1997. Checklist das macrófitas aquáticas do Pantanal, Brasil. *Acta Bot. Brasil.* 11: 215–227.
- St. John, H. 1961. Monograph of the genus *Egeria* Planchon. *Darwiniana* 12: 293–307.
- . 1962. Note on the fruit of *Egeria najas* Planchon. *Darwiniana* 12: 523.
- . 1963. Monograph of the genus *Elodea* (Hydrocharitaceae). Part 3. The species found in northern and eastern South America. *Darwiniana* 12: 639–653.
- . 1967. The pistillate flowers of *Egeria densa* Planchon. *Darwiniana* 14: 571–573.